The Construction and Development of Standard System for Intelligent and Connected Vehicles in China

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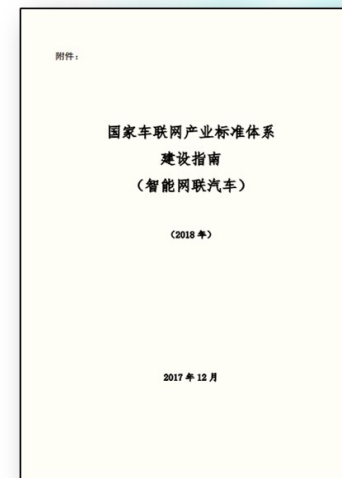
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Part 1

Background of Construction of ICV Standard System

Old

2017 Version

2017.12

◆ The construction of the system has been planned and deployed in stages

◆ Form a prototype of the logical hierarchy and technical fields

◆ The System is capable of supporting driver assistance and low-level automated driving

New

2023 Version

2023.07

◆ Systematically summarize the achievements of the first phase of construction

◆ Planning the construction of the standard system in the stages of 2025 and 2030

◆ The logical hierarchy is clearer and the technical fields are more comprehensive

◆ Meet the new needs of technology integration and cross-field development

◆ The System is capable of supporting high-level automated driving

ICV: intelligent and connected vehicles
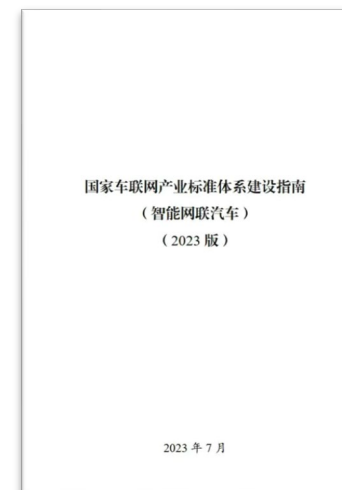
The Establishment of ICV Sub-committee

- Confirm the working scope is the standardization of fields such as vehicle driving environment perception and warning, driving assistance, automated driving and information services on vehicle
- Carry out related standardization work such as hundreds of times meetings and discussions so as to develop multiple national standards

The Establishment of First Stage's ICV Standard System

- The construction of the standard system focuses on basics, safety assurance, driving assistance, automated driving, connection functions and applications, resource management and information services
- Develop standards through 10 working groups, comprehensively carry out research on standard routes in subdivision fields
- Initially establish a system that is capable of supporting driver assistance and low-level automated driving
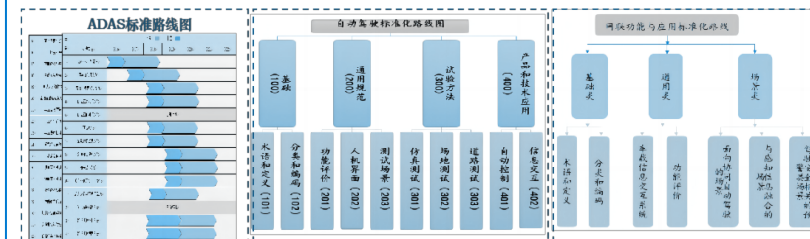
At the same time, China actively participates in the harmonization of international regulations and standards for ICVs

CNTARC 中汽中心 | NTCAS 全国汽车标准化技术委员会
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Technical Progress

- Perception and control algorithms
- Combined driving assistance
- Automated driving
- Connection technology
- Cybersecurity and data security

Industrial Development

- ADAS and AD are maturing
- Connection technology are expanding
- Software and chips are more valuable
- Data and platform are growing
- New security technologies are more important

Governmental Supervision

- Industry goes into the stage of mass production and application
- The functional scope of ADAS and the responsibility boundary of AD need to be clarified
- A comprehensive security system needs to be established
- Safety requirements and development costs need balance
- Policies and international regulations need coordination

Based on the above demands, we follow these principles to establish the new system

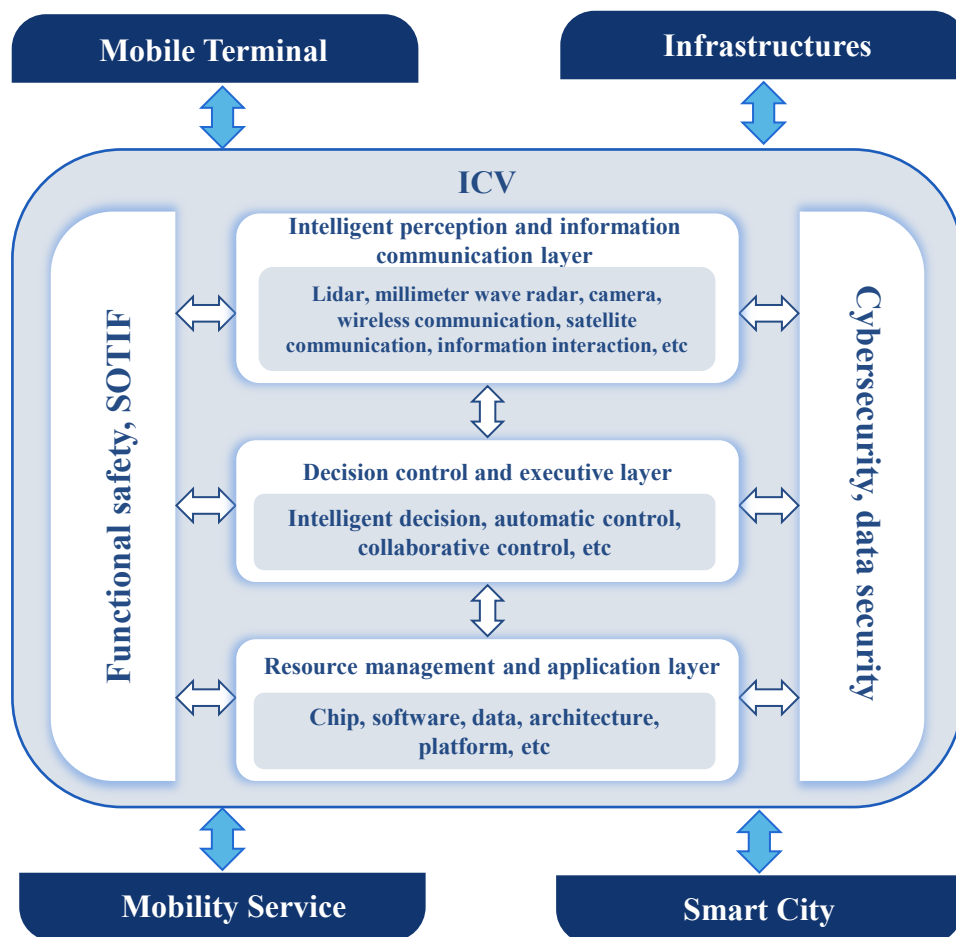| Overall Planning | Ensure Safety | Compatible, Dynamic | Serve Demands |

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Contents of the ICV Standard System (2023 Version)

Take full account of ICV technology classification and cross-field collaboration, and form a "three horizontal and two vertical" technical logic architecture

Mobile Terminal

Infrastructures

ICV

Functional safety, SOTIF

Intelligent perception and information communication layer

Lidar, millimeter wave radar, camera, wireless communication, satellite communication, information interaction, etc

Decision control and executive layer

Intelligent decision, automatic control, collaborative control, etc

Resource management and application layer

Chip, software, data, architecture, platform, etc

Cybersecurity, data security

Mobility Service

Smart City

Technology Classification

◆ **Horizontal** : The technology logic components supporting ICV function are classified to form a three-layer architecture: top layer perception and communication, middle layer decision and control, and bottom layer resource management application support.

◆**Vertical：** The ICV security technology is sorted out to form a two-tier architecture: the tier of functional safety and SOTIF, the tier of cybersecurity and data security.

Cross-domain Technology Interaction

◆ Considering the technical correlation between ICV and transportation, communication, electronics and other fields, reflecting the characteristics of cross-industry collaboration, and jointly building an organic whole of collaborative development with ICV as the core.

The framework is formed by considering different functions, products and technologies and the relationship among them comprehensively

ICV Standard System 2023 Version

(100)Basics
- (110) Terms and Definitions
- (120) Classification
- (130) Symbols and Codes

(200)General Specifications
- (210) Functional Safety and SOTIF
- (220) Cybersecurity and Data Security
- (230) HMI
- (240) Maps and Positioning
- (250) EMC
- (260) Evaluation System and Tools

(300)Application of Products and Technologies
- (310) Information Perception and Integration
- (320) Advanced Driving Assistance
- (330) Automated Driving
- (340) Connection Function and Application
- (350) Resource Management and Application

- (211)Functional Safety
- (212)SOTIF
- (221)Cybersecurity
- (222)Data Security
- (231)Driving Interaction
- (232)Cockpit Interaction
- (261) Ability to Evaluate and Audit
- (262) Management and Development Process
- (263) Test Equipment and Tools
- (264) Test Scenarios
- (311) Radar and Camera
- (312) Vehicle Information Interaction Terminal
- (313) Perception Fusion
- (321) Information Assistance
- (322) Control Assistance
- (331) Functional Specification
- (332)Test Methods
- (333) Critical System
- (341) Functional Specification
- (342) Application of Connection Technology
- (351) Platform Architecture
- (352)Vehicle Software
- (353)Vehicle Chips

Major Changes

Moderate increase in quantity:
Planning 140+ standards

More clear in logic:
- ✓ The first level is categorized by standard type
- ✓ The second level is categorized by technical field
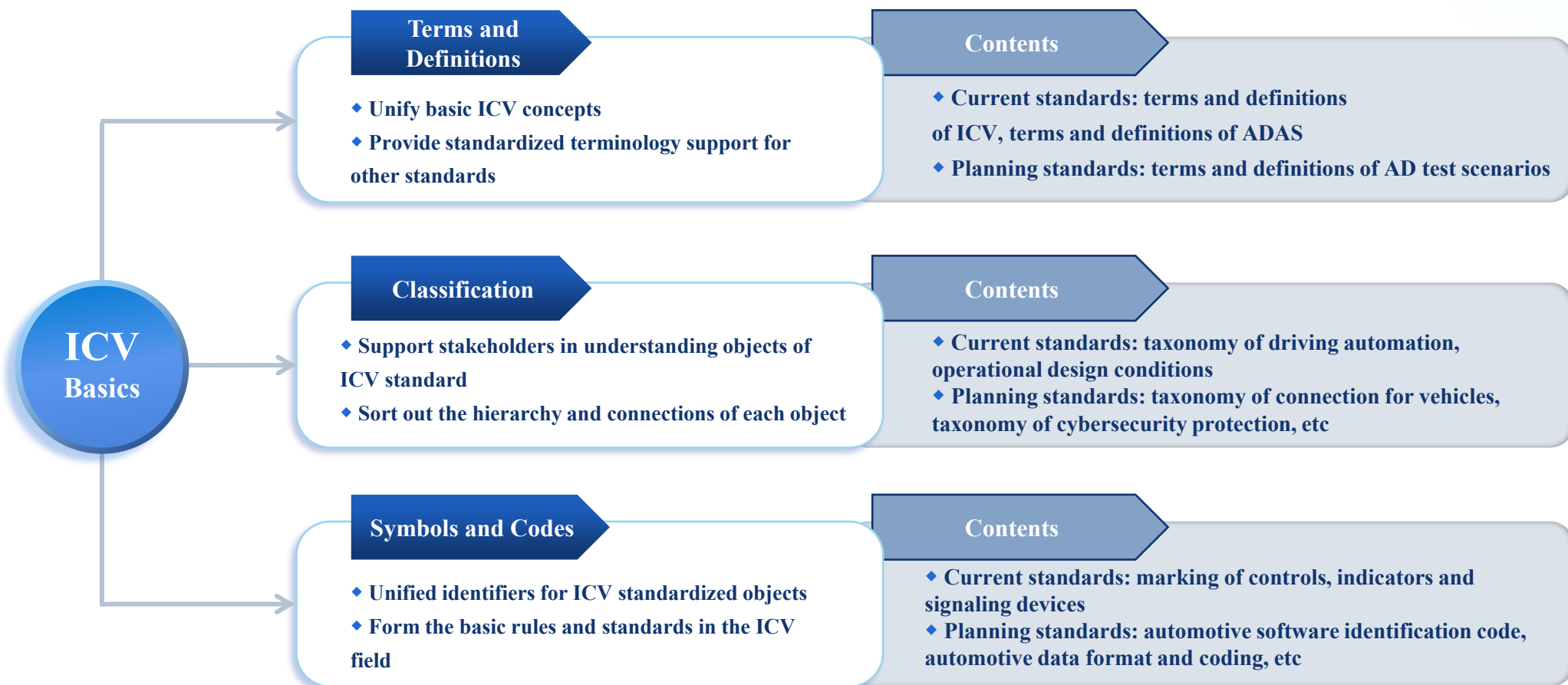- ✓ The third level is categorized by standard content

More comprehensive in fields:
- ✓ Add the field of data security
- ✓ Add the field of evaluation systems and tool
- ✓ Add the field of resource management and application

More complete in contents:
- ✓ Cover common key technologies such as platform architecture, vehicle software and chips

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Unify basic ICV concepts, clarify objects and boundaries, and form a standardized "common language"

ICV Basics

Terms and Definitions

- ◆ Unify basic ICV concepts
- ◆ Provide standardized terminology support for other standards

Contents

- ◆ Current standards: terms and definitions of ICV, terms and definitions of ADAS
- ◆ Planning standards: terms and definitions of AD test scenarios

Classification

- ◆ Support stakeholders in understanding objects of ICV standard
- ◆ Sort out the hierarchy and connections of each object

Contents

- ◆ Current standards: taxonomy of driving automation, operational design conditions
- ◆ Planning standards: taxonomy of connection for vehicles, taxonomy of cybersecurity protection, etc

Symbols and Codes

- ◆ Unified identifiers for ICV standardized objects
- ◆ Form the basic rules and standards in the ICV field

Contents

- ◆ Current standards: marking of controls, indicators and signaling devices
- ◆ Planning standards: automotive software identification code, automotive data format and coding, etc

★ **Build a New Four-dimensional Safety System for ICV**

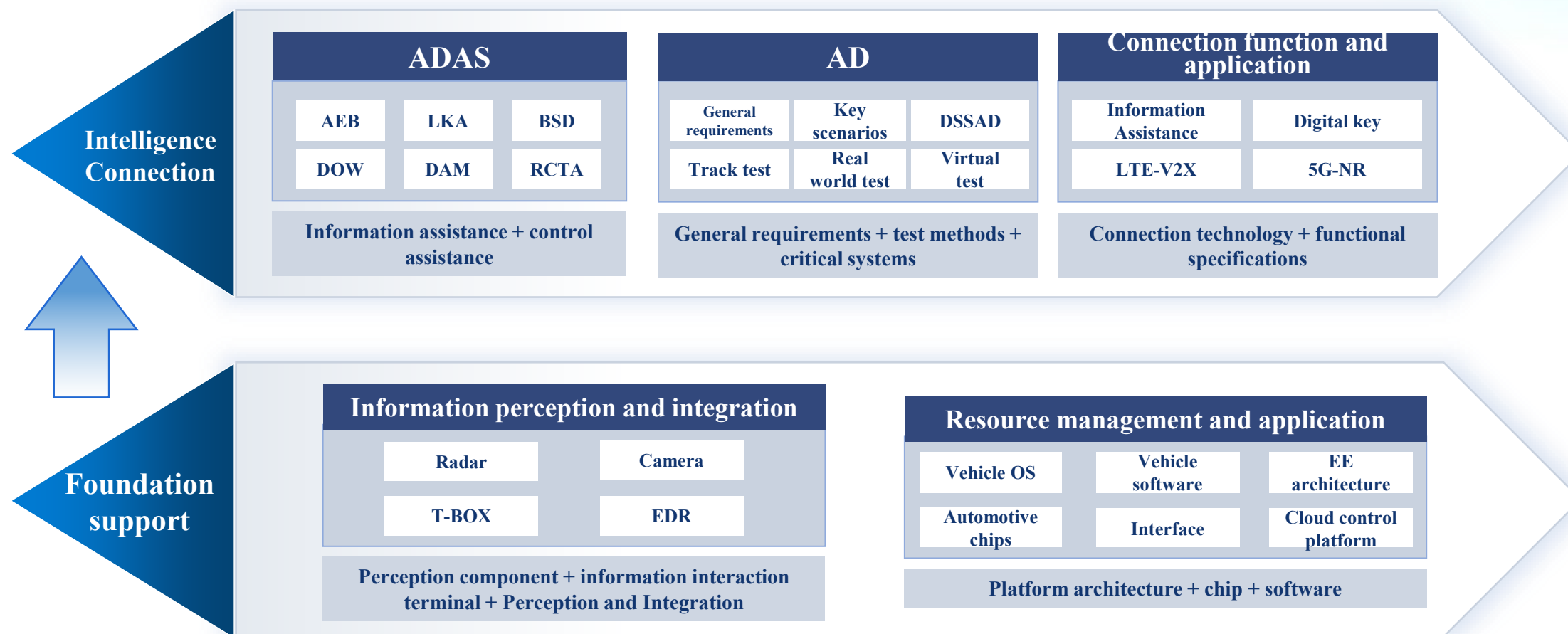| General Specifications and Standards of ICV Technology and Product Safety	
Functional Safety **ensures safe operation of the vehicle in case of electrical and electronic system failure** Functional safety requirements and testing, functional safety testing of automated driving V2X interactive, functional safety audit and evaluation, etc	**Cybersecurity** **Safety assurance and safety technology standards** Vehicle information security, software upgrade, gateway, interactive system, remote terminal, diagnostic interface information security, etc
Safety Of The Intended Functionality (SOTIF) **Avoid risks caused by inadequate design, performance limitations, and human misuse** SOTIF 、 verification methods of SOTIF, etc	**Data security** **Ensure that ICV data is effectively protected and legally exploited, and have the ability to ensure continued security** Data general requirements, data security management system, data application and sharing, etc

★ **New General Specifications and Standards such as Cockpit Interaction, Map Positioning, EMC, and Evaluation System have been added**

New common specification standards to support the implementation of ICV functions	
Human Machine Interface (HMI) **Driving interaction and cockpit interaction** Signal prompt general requirements, user notification, face recognition, etc	**Maps and Positioning** **Coordinate system, vehicle map, positioning, navigation** Integrated positioning, vehicle maps, inertial navigation, etc
Electromagnetic Compatibility (EMC) **Test scenarios, adaptability requirements, test methods** ICV electromagnetic compatibility test scenarios, ICV electromagnetic compatibility test methods, etc	**Evaluation systems and tools** **Evaluation and audit capabilities, management and development processes, equipment and tools, test scenarios** Perception evaluation target, automated driving test scenario, subjective evaluation, etc

Form the standards of application of products and technologies based on intelligence and connection function, supported by perception and integration, resource management and application

Intelligence Connection

ADAS
AEB	LKA	BSD
DOW	DAM	RCTA

Information assistance + control assistance

AD
General requirements	Key scenarios	DSSAD
Track test	Real world test	Virtual test

General requirements + test methods + critical systems

Connection function and application
Information Assistance	Digital key
LTE-V2X	5G-NR

Connection technology + functional specifications

Foundation support

Information perception and integration
Radar	Camera
T-BOX	EDR

Perception component + information interaction terminal + Perception and Integration

Resource management and application
Vehicle OS	Vehicle software	EE architecture
Automotive chips	Interface	Cloud control platform

Platform architecture + chip + software

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Part 3

Prospect of Construction of ICV Standard System

-1- Improve the ICV management from the supply and support of standard

-2- Plan and guide the development path of ICV technology

-3- Establish and improve the ICV test and evaluation system

-4- Promote the reformation and innovation in the forms of ICV standard

-5- Revise the traditional vehicle standards and improve their fitness for ADS through screening and analysis work

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With a view to 2025 and 2030, a standard system for ICVs that adapts to China's national conditions and harmonized with international standards will be established in stages

2025

To form a standard system for ICVs that can support the general functions of combined driving assistance and automated driving

More than 100 related standards will be developed or revised

2030

A comprehensive ICV standard system that can support the harmonized development of single vehicle intelligence and multiple vehicles connection will be formed systematically

More than 140 related standards will be developed or revised